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The Effects of Native Forests Conservation and Preservation Scenarios on Two Chilean Basins Water Cycle, under Climate Change Conditions

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Abstract : The hydrological cycle is influenced by multiple factors, including climate change, land use changes, and anthropogenic activities, all of which threaten water availability and quality worldwide. In recent decades, numerous investigations have used landscape metrics and hydrological modeling to demonstrate the influence of landscape patterns on the hydrological cycle components' natural dynamics. Many of these investigations have determined the repercussions on the quality and availability of water, sedimentation, and erosion regime, mainly in Asian basins. In fact, there is progress in this branch of science, but there are still unanswered questions for our region. This study examines the hydrological response in Chilean basins under various land use change scenarios (LUCC) and the influence of climate change. The components of the water cycle were modeled using a physically distributed type hydrological and hydraulic simulation model based on and oriented to mountain basins TETIS model. Future climate data were derived from Chilean regional simulations using the WRF-MIROC5 model, forced with the RCP 8.5 scenario, at a 25 km resolution for the periods 2030-2060 and 2061-2091. LUCC scenarios were designed based on nature-based solutions, landscape pattern influences, current national and international water conservation legislation, and extreme scenarios of non-preservation and conservation of native forests. The scenarios that demonstrate greater water availability, even under climate change, are those promoting the restoration of native forests in over 30% of the basins, even alongside agricultural activities. Current legislation promoting the restoration of native forests only in riparian zones (30-60 m or 200 m in steeper areas) will not be resilient enough to address future water shortages. Evapotranspiration, direct runoff, and water availability at basin outlets showed the greatest variations due to LUCC. The relationship between hydrological modeling and landscape configuration is an effective tool for establishing future territorial planning that prioritizes water resource protection.

Keywords : TETIS, landscape pattern, hydrological process, water availability, Chilean basins
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